Photochemical Ozone Loss in the Arctic Region in Summer

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We will present an overview of our understanding of the photochemistry of O3 during Arctic summer based on balloon-borne, ozonesonde, and ground-based observations obtained during POLARIS. Observations show a steady decline in column O3 over Fairbanks from ~425 DU in March 1997 to ~275 DU in September 1997. The lack of appreciable trends in the column abundance of HF suggests the observed reduction in column O3 was not caused by large scale dynamical processes. Profiles of O3 measured by the balloon-borne UV photometer and ozonesondes show that prior to July the largest reductions in O3 occurred below ~25 km. These reductions then propagated to higher altitudes later in the season.

Balloon-borne observations of the concentrations of NO and NO2 obtained by the MkIV interferometer provide an empirical measure of the photochemical loss rate of O3, since these radicals participate in the dominant rate-limiting processes for loss of O3 during polar summer. The net photochemical removal rates of O3 (total loss minus production) based on the MkIV observations ranges from 5 to 15 %/month for altitudes between 16 and 25 km. The reductions in O3 observed during POLARIS are consistent with these loss rates, demonstrating that reactions involving nitrogen oxides are the primary cause of the large reduction reductions in column O3 observed during POLARIS.